

CLAIMS

What is claimed is:

1. A method of patterning a first resist on a semiconductor wafer using a mask, the method comprising:

- 5 providing a semiconductor substrate having a plurality of semiconductor die;
 forming a first resist over the semiconductor substrate;
 reflecting radiation off of the mask to create reflected radiation, wherein the mask
 comprises:
 providing a substrate;
10 forming a reflective stack over the substrate;
 forming an absorber over the reflective stack;
 forming a first hardmask layer over the absorber, wherein the first hardmask
 layer comprises carbon;
 forming a second hardmask layer over the first hardmask layer, wherein the
15 second hardmask layer has a thickness no greater than approximately 20
 nanometers;
 forming a second resist over the second hardmask layer;
 patterning the second resist to form a first pattern;
 transferring the first pattern from the second resist to the second hardmask
20 layer and the first hardmask layer;
 removing the second resist;
 transferring the first pattern from the first hardmask layer and the second
 hardmask layer to the absorber; and
 removing the first hardmask layer and the second hardmask layer; and
25 exposing the first resist to the reflected radiation to form a second pattern in the first
 resist.

2. The method of claim 1, wherein the forming the second hardmask layer over the first
hardmask layer further comprises forming the second hardmask layer, wherein the second
30 hardmask layer comprises silicon.

3. The method of claim 2, wherein the forming the second hardmask layer over the first hardmask layer further comprises forming the second hardmask layer, wherein the second hardmask layer further comprises oxygen.
- 5 4. The method of claim 2, wherein the forming the second hardmask layer over the first hardmask layer further comprises forming the second hardmask layer, wherein the second hardmask layer further comprises nitrogen.
5. The method of claim 2, wherein the forming the second hardmask layer over the first
10 hardmask layer further comprises forming the second hardmask layer, wherein the second hardmask layer further comprises silicon and nitrogen.
6. The method of claim 1, wherein the forming the second hardmask layer over the first hardmask layer further comprises forming the second hardmask layer, wherein the second
15 hardmask layer comprises a material selected from the group consisting of silicon dioxide, silicon nitride, and silicon oxynitride.
7. The method of claim 1, wherein the forming the second hardmask layer over the first hardmask layer further comprises forming the second hardmask layer, wherein the second
20 hardmask layer is substantially translucent to the reflected radiation.
8. A method of patterning a first resist on a semiconductor wafer using a mask, the method comprising:
- providing a semiconductor substrate having a plurality of semiconductor die;
 forming a first resist over the semiconductor substrate;
25 reflecting radiation off of the mask to create reflected radiation, wherein the mask comprises:
 providing a substrate;
 forming a reflective stack over the substrate;
 forming an absorber over the reflective stack;
30 forming a first hardmask layer over the absorber, wherein the first hardmask layer comprises carbon;

- forming a second hardmask layer over the first hardmask layer, wherein the second hardmask layer is substantially translucent to the reflected radiation;
- forming a second resist over the second hardmask layer;
- 5 patterning the second resist to form a first pattern;
- transferring the first pattern from the second resist to the second hardmask layer and the first hardmask layer;
- removing the second resist;
- transferring the first pattern from the first hardmask layer and the second
- 10 hardmask layer to the absorber; and
- removing the first hardmask layer and the second hardmask layer; and
- exposing the first resist to the reflected radiation to form a second pattern in the first resist.
- 15 9. The method of claim 8, wherein the forming the second hardmask layer over the first hardmask layer further comprises forming the second hardmask layer, wherein the second hardmask layer comprises silicon.
10. The method of claim 9, wherein the forming the second hardmask layer over the first
- 20 hardmask layer further comprises forming the second hardmask layer, wherein the second hardmask layer further comprises oxygen.
11. The method of claim 9, wherein the forming the second hardmask layer over the first hardmask layer further comprises forming the second hardmask layer, wherein the second
- 25 hardmask layer further comprises nitrogen.
12. The method of claim 9, wherein the forming the second hardmask layer over the first hardmask layer further comprises forming the second hardmask layer, wherein the second hardmask layer further comprises silicon and nitrogen.
- 30 13. The method of claim 8, wherein the forming the second hardmask layer over the first hardmask layer further comprises forming the second hardmask layer, wherein the second hardmask layer comprises a material selected from the group consisting of silicon dioxide, silicon nitride, and silicon oxynitride.

14. The method of claim 8, wherein the forming the second hardmask layer over the first hardmask layer further comprises forming the second hardmask layer, wherein the second hardmask layer comprises a thickness no greater than approximately 20 nanometers.

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15. A method for fabricating a mask, the method comprising:

providing a substrate;

forming a reflective stack over the substrate;

forming an absorber over the reflective stack;

10 forming a first hardmask layer over the absorber, wherein the first hardmask layer comprises carbon;

forming a second hardmask layer over the first hardmask layer, wherein the second hardmask layer is substantially translucent to the reflected radiation;

15 forming a second resist over the second hardmask layer;

patterning the second resist to form a first pattern;

transferring the first pattern from the second resist to the second hardmask layer and the first hardmask layer;

removing the second resist;

20 transferring the first pattern from the first hardmask layer and the second hardmask layer to the absorber; and

removing the first hardmask layer and the second hardmask layer.

16. The method of claim 15, wherein the forming the second hardmask layer over the first hardmask layer further comprises forming the second hardmask layer, wherein the second hardmask layer comprises silicon.

17. The method of claim 16, wherein the forming the second hardmask layer over the first hardmask layer further comprises forming the second hardmask layer, wherein the second hardmask layer further comprises oxygen.

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18. The method of claim 16, wherein the forming the second hardmask layer over the first hardmask layer further comprises forming the second hardmask layer, wherein the second hardmask layer further comprises nitrogen.

19. The method of claim 16, wherein the forming the second hardmask layer over the first hardmask layer further comprises forming the second hardmask layer, wherein the second hardmask layer further comprises silicon and nitrogen.

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20. The method of claim 15, wherein the forming the second hardmask layer over the first hardmask layer further comprises forming the second hardmask layer, wherein the second hardmask layer comprises a thickness no greater than approximately 20 nanometers.

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